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(71) Applicant *(for all designated States except US)*: VSL FRANCE [FR/FR]; 110, avenue de Verdun, F–91520 Egly (FR).

(72) Inventors; and
(75) Inventors/Applicants *(for US only)*: GOULESCO, Nicolas [FR/FR]; 16, rue Bauer, F–75014 Paris (FR). LU, Raphaël [FR/FR]; 10, route de Dourdan, F–91470 Angervilliers (FR).

(74) Agents: MARTIN, Jean–Jacques et al.; Cabinet Regimbeau, 26, avenue Kléber, F–75116 Paris (FR).

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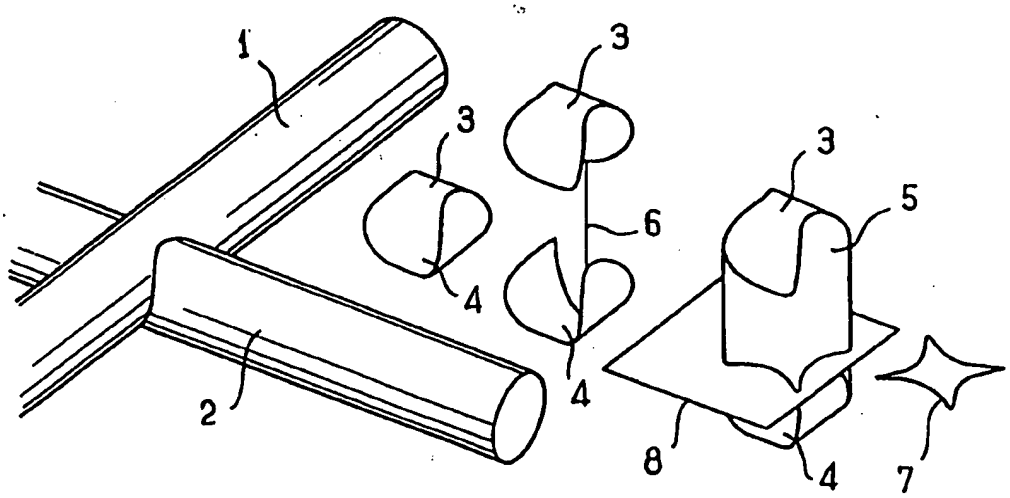
(54) Title: A REINFORCED EARTH SYSTEM AND ITS REINFORCING GRID



(57) Abstract

A retaining mesh unit to be embedded in a soil formation, the mesh being made of crossed metal wires or bars (1, 2) that are welded together at their cross–points without using a filler metal, the mesh being characterized in that the wires or bars of the mesh penetrate into each other at a cross–point with a degree of penetration such that the mesh presents substantially uniform resistance to corrosion over time. The invention is particularly applicable to soil formation retaining system.

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A REINFORCED EARTH SYSTEM AND ITS REINFORCING GRID

The invention relates to a metal mesh unit to be embedded in a natural or artificial soil formation, e.g. a mass of earth, sand, or any other natural synthetic material, possibly under water, to be held therein essentially by abutment effects.

The mesh serves as reinforcing means for the soil formation and as anchor for soil retaining elements disposed in front of the formation.

Mesh units are made of bars or wires that are crossed and welded together at their cross-points so as to make a mesh.

Until now, it has been common practice to use mesh units originally designed for other applications, specifically grids as used for reinforcing concrete structures.

In that application, the wires or bars of the mesh unit are welded together without using a filler metal (in order to avoid galvanic effects), so that the welds can withstand shear equal to 30% of the value which would break a wire of the mesh in tension.

Unfortunately, the use of such a mesh in a soil gives rise to problems of longevity, particularly because of the risk of corrosion, and it is necessary to satisfy requirements that are not satisfied by welds designed for use in a concrete reinforcing grid.

It has thus been found necessary to define mesh units that are specially designed for application in a soil, particularly in a soil of earth.

According to the present invention, it has been found that the wires or bars of the mesh need to be welded together with a degree of penetration of a wire or bar in another wire or bar at a cross-point that is such that the resistance of the mesh to corrosion is substantially uniform over time, i.e. that the rate at

which wire or bar material in the mesh is consumed by the effects of corrosion is substantially the same at the location of a weld as at any other location of the mesh.

According to a characteristic of the invention, when welding without a filler metal, the depth of penetration of a wire or bar in another wire or bar should be 8% to 30% of the sum of the diameters of the two wires or bars, and preferably 8% to 16% of said sum.

The area of the projection of the outline of the indentation of one wire or bar in the other at a cross-point, in a plane parallel to the axes of the two wires, then lies in the range 60% to 120% and preferably in the range 60% to 100% of the area of the right section of the smaller diameter wire or bar.

The wires or bars of the mesh are generally of circular right section, however it is not impossible, for some special reason, to use wires or bars having a section of some other shape, in which case the term "diameter" as applied to a wire or a bar designates the diameter of a circular section having an area that is equal to the right sectional area of the wire or bar.

Preferably, but not essentially, the mesh is made up of parallel longitudinal wires or bars that are preferably uniformly spaced apart, and preferably of the same length, together with parallel transverse wires or bars that are preferably uniformly spaced apart and preferably of the same length, extending perpendicularly to the longitudinal wires or bars that they interconnect, and that are preferably of the same diameter.

Preferably, smooth wires or bars of steel having a high elastic limit are used, with a diameter of not less than 8 mm.

In practice, the mesh generally comprises two to six longitudinal wires or bars that are spaced apart by 30 cm, for example.

The meshes can be placed in juxtaposed or successive strips, and the strips can optionally be interconnected.

The invention is explained in greater detail below with reference to the figures of the accompanying drawings, in which:

· Figure 1 is a diagram of a mesh used for reinforcing a soil and for retaining a front plate of the soil (M);

· Figures 2 to 11 show ways in which a cross-shaped weld can be made between two meshes bars by electric welding, with a degree of penetration of one bar in the other that increases from one figure to the next, from a degree of 0% (Figure 2) up to a degree of 100% (Figure 11); and

· Figure 12 is a graph in which the curves plot values that are a function of the degree of penetration.

In Figure 1, there is shown diagrammatically a mesh that is made up of crossed bars (1, 2) which hold a plate (P) on the front of a soil formation (M).

The figure does not show means for securing the mesh to the plate, such means not being characteristic of the invention and being capable of being constituted in any conventional manner.

For example, reference can be made to the devices described in the following publications: US 4 449 857, US 4 725 170, US 4 324 508.

It should be observed that a plate is merely one example of an element that can be held on the front of a soil formation to retain the formation, where such elements can be selected from the group constituted by rigid plates, flexible films, sheets, nets, etc. ... .

In each of Figures 2 to 10, there are shown in perspective:

· two crossed bars (1, 2) of the mesh;

· the three-dimensional shape (4) of the intersection between two bars, shown on the bar (1);

· the three-dimensional shape (4) of the intersection between two bars, shown on the bar (2);

· the virtual cylinder (5) which would be generated by a generator line (6) moving parallel to itself, following the outlines of the shapes (3) and (4); and

· the shape (7) of the intersection of the virtual cylinder (5) and a plane (8) perpendicular to the axis of said cylinder.

The area of the shape (7) is the area referred to above as the area of the projection of the outline of the indentation of a wire or bar in the other wire or bar at the cross-point between the two wires or bars.

In the table below, for each of the degrees of penetration No. 1 to No. 10 corresponding to Figures 2 to 11, there is given the area (A) of the shape (7), the perimeter (P) of said shape, and the circumference (C) of the area of the warped shape (3 or 4) for bars having a diameter of 10 mm:

No.	A	P	C
1	28.97	19.10	19.63
2	53.13	25.93	27.46
3	72.29	30.41	33.33
4	86.16	33.55	38.24
5	94.46	35.79	42.62
6	96.66	37.43	46.78
7	91.91	38.79	50.99
8	78.66	40.40	55.66
9	53.63	43.45	61.57
10	0.00	56.56	76.40

Figure 12 plots curves showing how the values of A (square points), of (P) (lozenge-shaped points), and of (C) (triangular points), as taken from the above table, vary as a function of the degrees of penetration 1 to 10 which are plotted along the abscissa.

For bars having a diameter of 10 mm, penetrations of 8%, 16%, 25%, and 30% correspond respectively to abscissa values (1, 6), (3, 2), (5) and (6).

It can be seen that a degree of penetration of 16% (abscissa 3, 2) corresponds to an area (A) close to the area of the right section of a bar, which area is 78 mm^2.

CLAIMS

1/ A reinforcing mesh unit to be embedded in a soil formation, the mesh being made of crossed metal wires or bars (1, 2) that are welded together at their cross-points without using a filler metal, the mesh being characterized in that the wires or bars of the mesh penetrate into each other at a cross-point with a degree of penetration such that the mesh presents substantially uniform resistance to corrosion over time.

2/ A mesh unit according to claim 1, in which the depth of penetration of a wire or bar (1) in the other wire or bar (2) lies in the range 8% to 30%, preferably in the range 8% to 16% of the sum of the diameters of the two wires or bars.

3/ A mesh unit according to either preceding claim, constituted by longitudinal parallel wires or bars (1) and by transverse parallel wires or bars (2) that are perpendicular to the longitudinal wires or bars that they interconnect.

4/ A mesh unit according to claim 3, in which the longitudinal and transverse wires or bars (1, 2) have the same diameter.

5/ A mesh unit according to claim 3 or 4, having two to six longitudinal wires or bars (1).

6/ A mesh unit according to any preceding claim, in which the wires or bars (1, 2) have a diameter of not less than 8 mm.

7/ A mesh unit according to any preceding claim, in which the wires or bars (1, 2) are smooth.

8/ A soil formation retaining system comprising at least one mesh unit according to any one of claims 1 to 7.

9/ A soil formation retaining system according to claim 8, having soil retaining elements applied to a face of the formation, which elements are fixed at one end of the said mesh.

10/ A soil formation retaining system according to claim 9, in which said elements are selected from the group comprising rigid plates, flexible films, sheets, and nets.

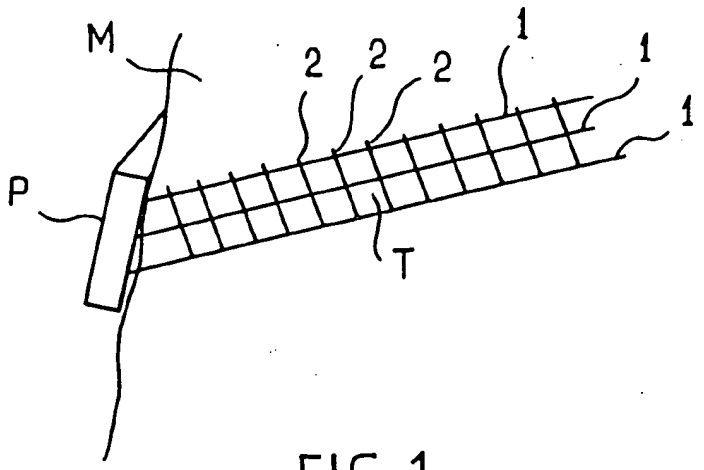

FIG_1

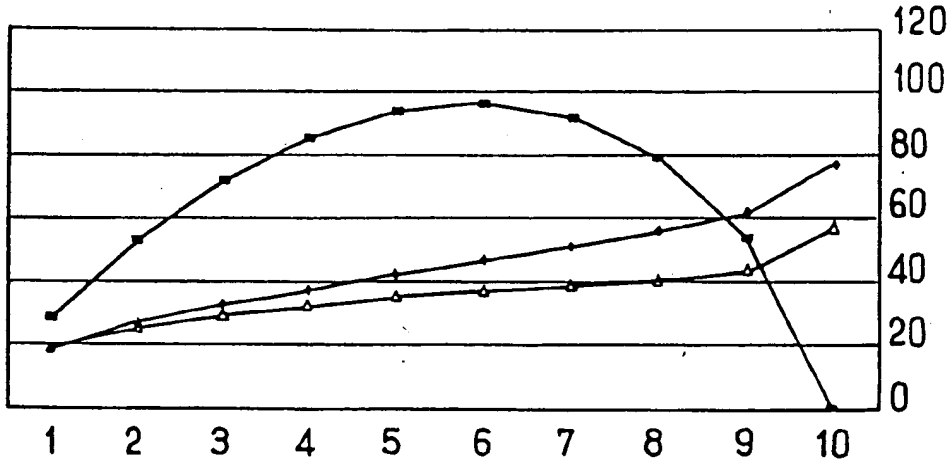

FIG_12

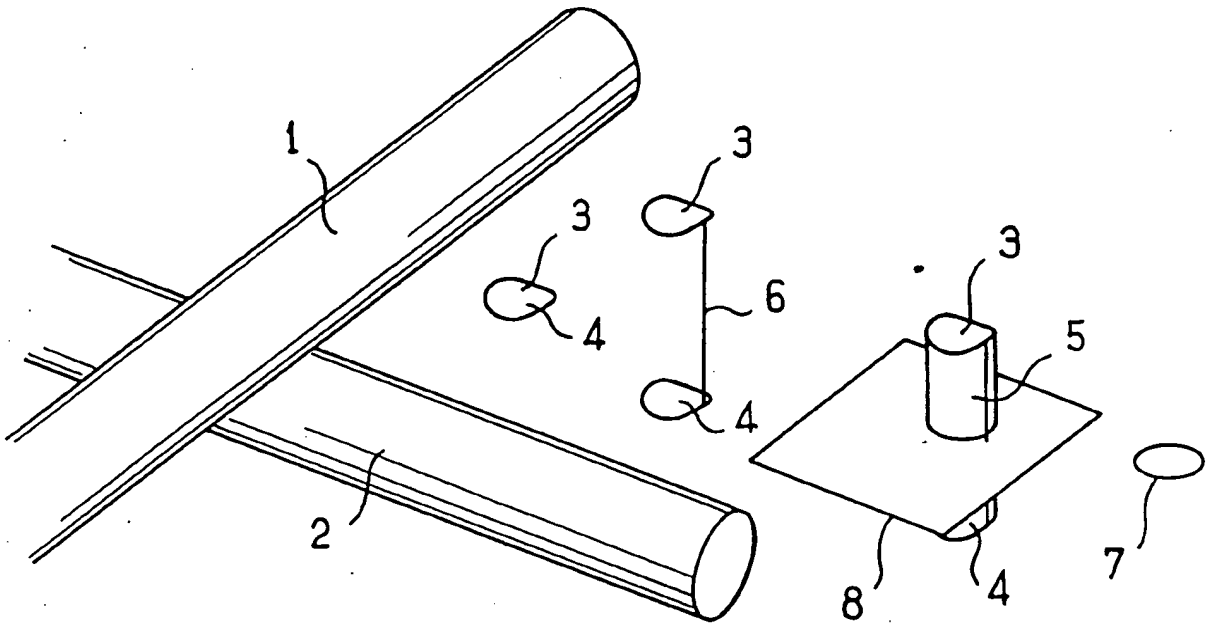

FIG.2

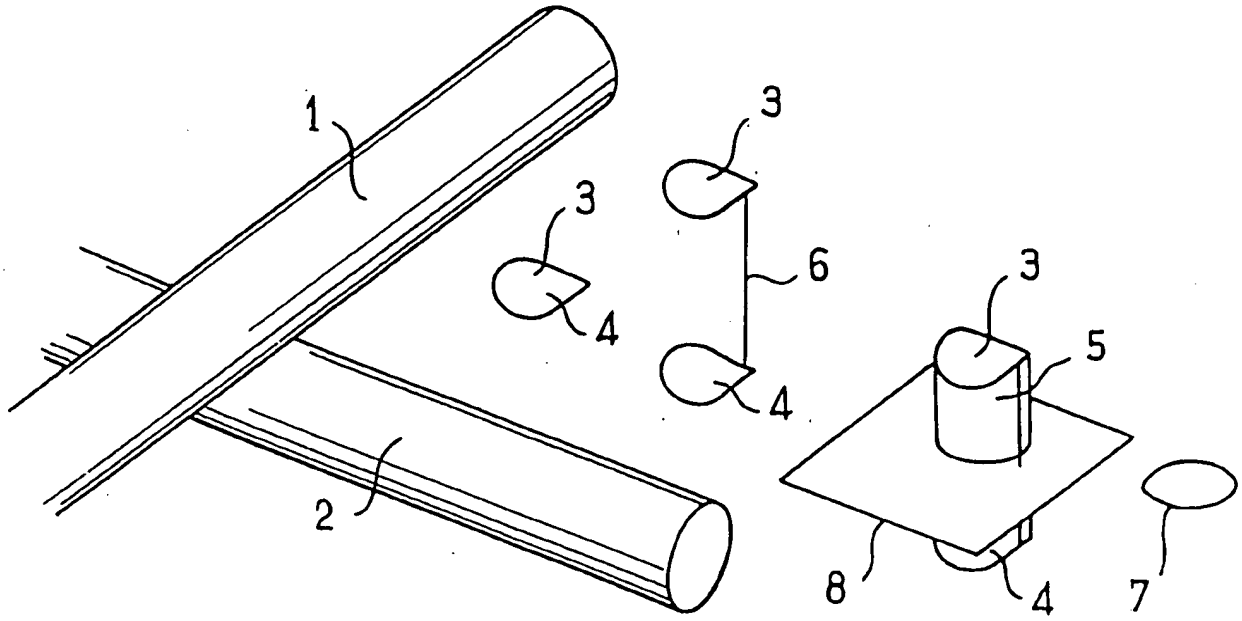

FIG.3

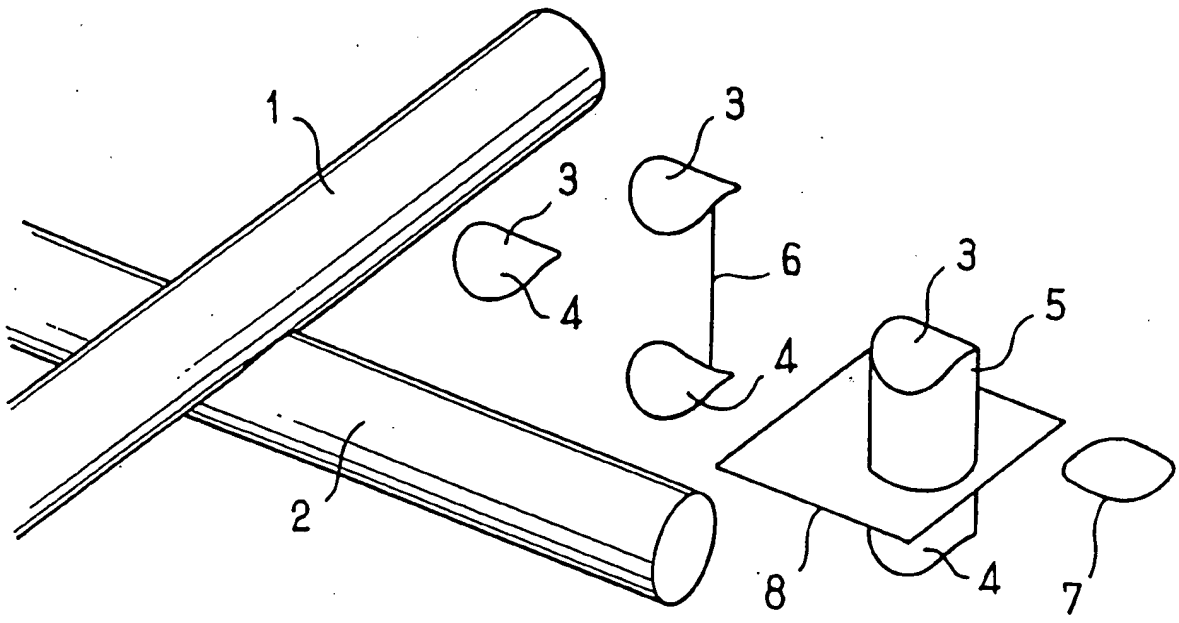

FIG_4

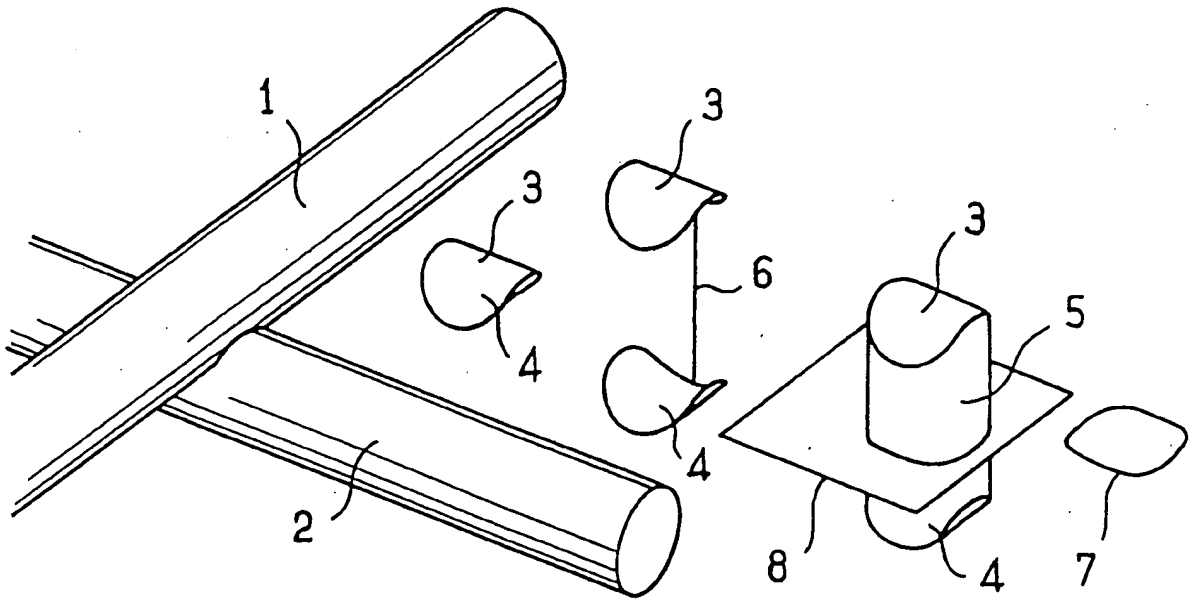

FIG_5

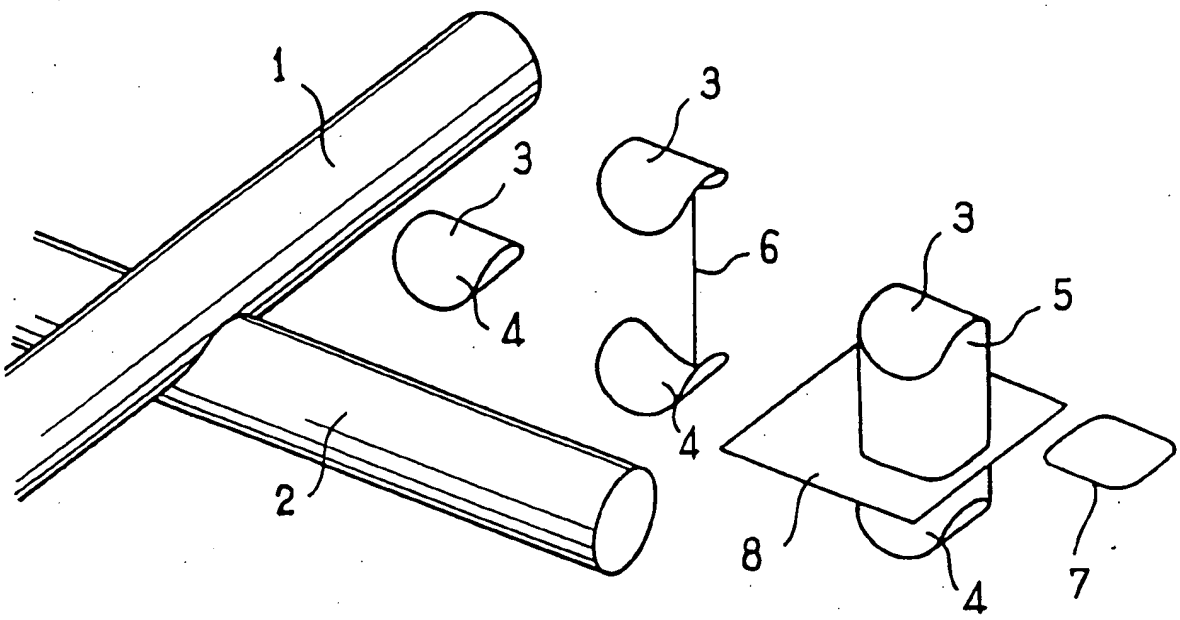

FIG_6

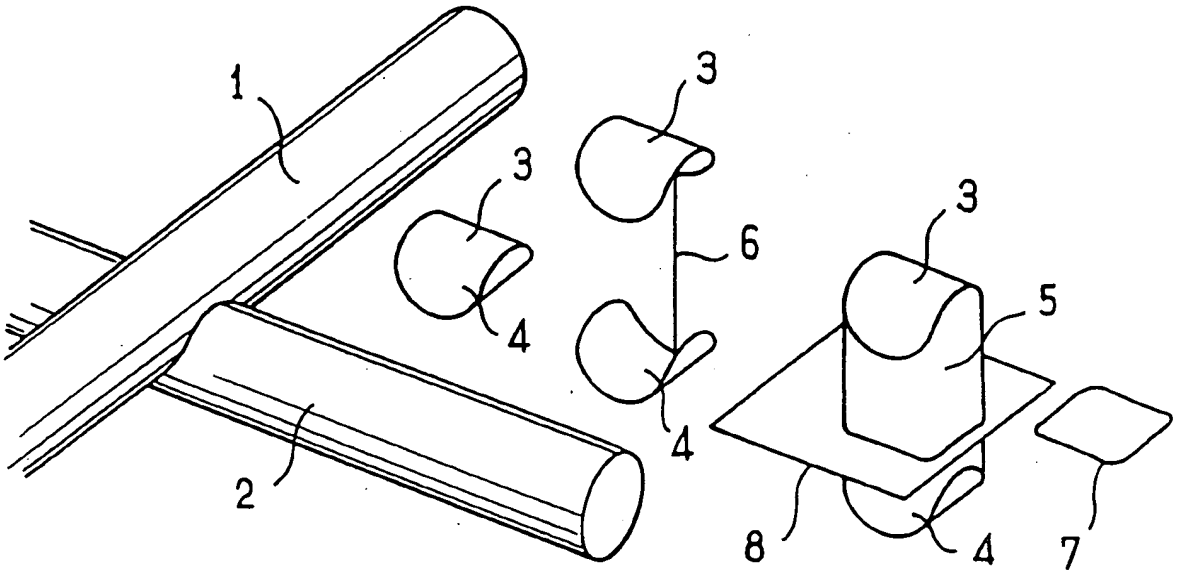

FIG_7

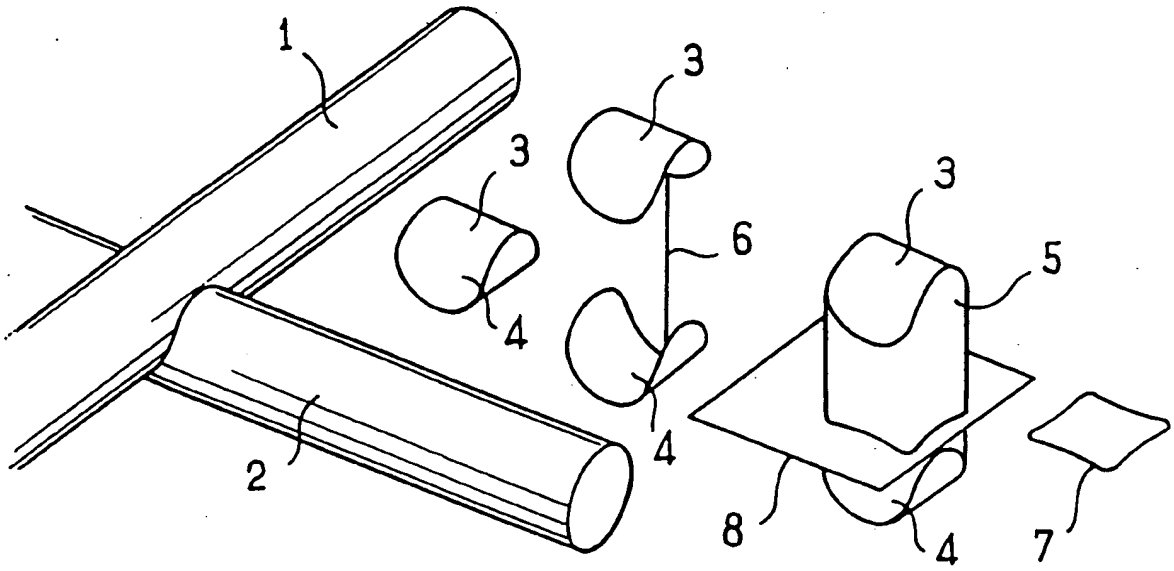

FIG_8

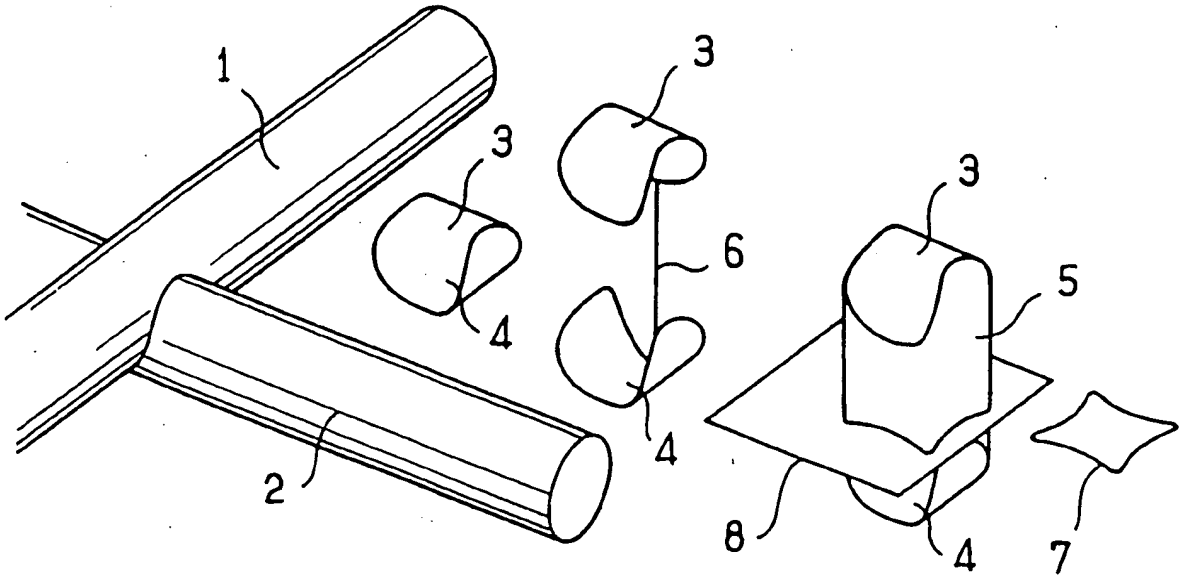

FIG_9

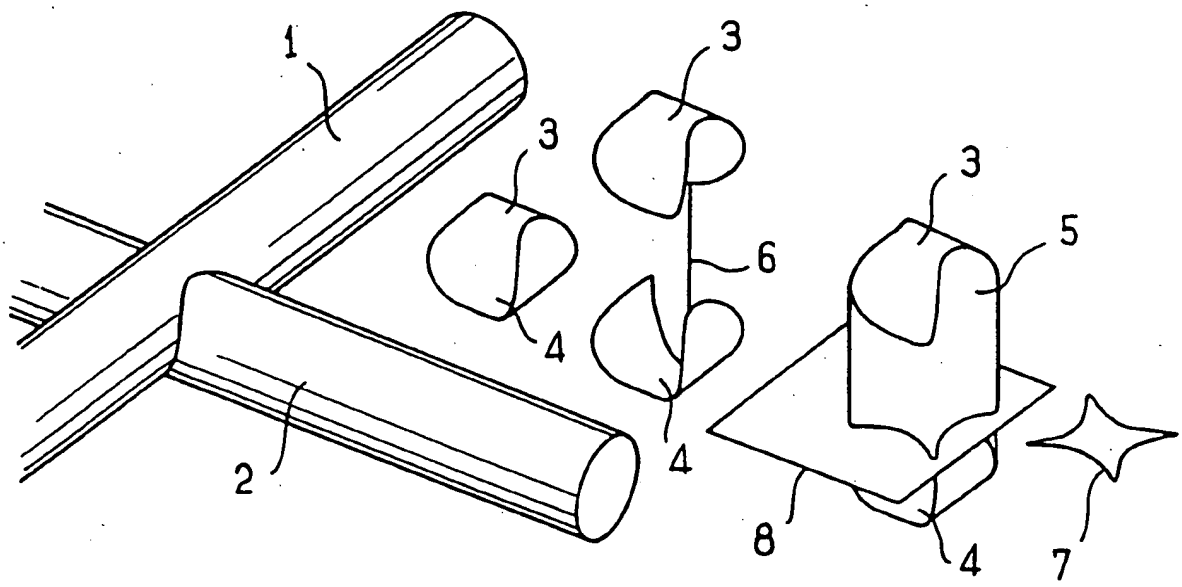

FIG_10

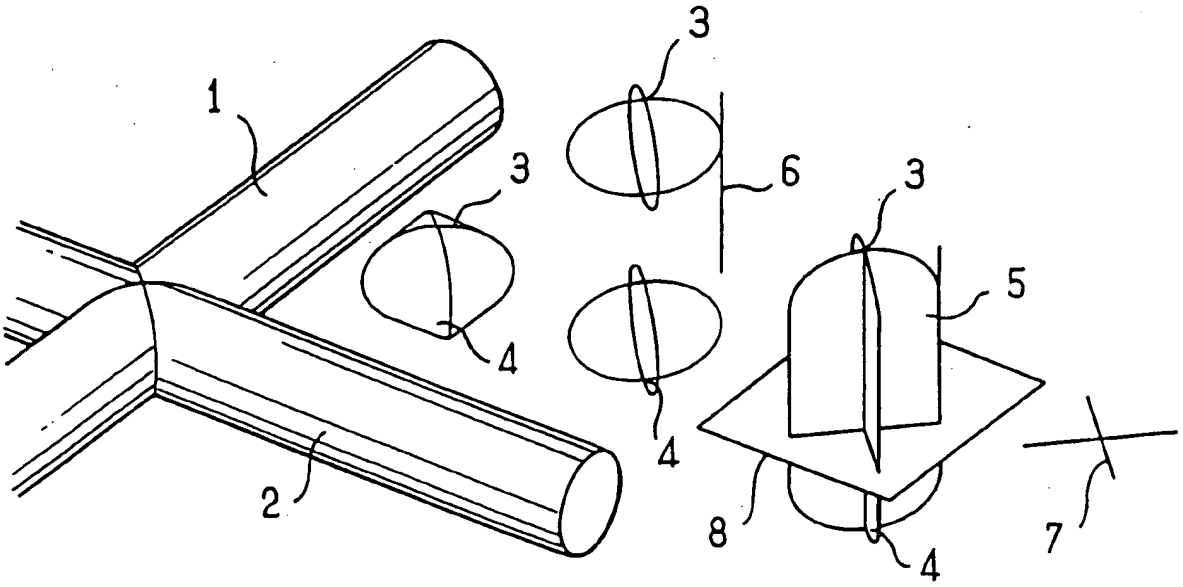

FIG_11

INTERNATIONAL SEARCH REPORT

Inte' 'onal Application No
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A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 E02D29/02 E04C5/04

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 E02D E04C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X Y A	FR 1 437 626 A (CONGY) 7 July 1966 (1966-07-07) page 2, line 2 - line 18; figures	1,3,4,6, 7 8-10 2,5
Y A	US 4 324 508 A (HILFIKER WILLIAM K ET AL) 13 April 1982 (1982-04-13) column 3, line 3 - line 15; figures	8-10 1,3-7
A	DE 17 09 339 A (FERROTEST GMBH) 3 August 1972 (1972-08-03) page 2, line 1 -page 3, line 18; figure	1

☐ Further documents are listed in the continuation of box C.

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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US 4324508 A	13-04-1982	NONE	
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